

WHAT IS CLAIMED IS:

1. A method of producing fuel from vegetable or animal fat, which has a free fatty acid (ffa) content by means of catalytic esterification reactions, comprising: esterification of free fatty acids contained in the fat at a higher temperature in a vacuum with one or more multivalent alcohols accompanied by solid neutral catalysts, which are present in a packing bed inside a reactor, whereby the fat travels from top to bottom in the reactor with the alcohol(s) running counter current and a mixture containing alcohol and water being removed from an upper part of the reactor by means of a vacuum effect.
2. The method according to claim 1, wherein the fat is selected from the group consisting of animal fats, waste fats, rendering fats, fats from oil traps, fat from sewage plants, fat from industrial processes, marine animal oils, vegetable fats or oils with a high concentration of free fatty acid, and combinations thereof.
3. The method according to claim 2, wherein the animal fat is land animal fat selected from the group consisting of pig lard, bovine and mutton suet, horse fat, and combinations thereof.
4. The method according to claim 2, wherein the marine animal oil is fish oil.
5. The method according to one of the claims 1 through 3, wherein the fats or oils are present in amounts ranging from about 5 to about 75 percent per weight free fatty acid content.
6. The method according to one of the claims 1 through 3, wherein the fats or oils are present in amounts ranging from about 15 to about 40 percent per weight free fatty acid content.
7. The method of claim 1, wherein the alcohol is selected from the group consisting of a divalent alcohol, trivalent alcohol, and combination thereof.

8. The method of claim 7, wherein the alcohol is selected from the group consisting of ethylene glycol, glycerine, and a combination thereof.
9. The method of claim 1, wherein the alcohol is used in a stoichiometric excess for the free fatty acid which is contained in the fats or oils.
10. The method of claim 1, wherein the esterification occurs at a temperature ranging from about 150 to about 220°C.
11. The method of claim 1, wherein the esterification occurs at a temperature preferably ranging from about 190 to about 200°C.
12. The method of claim 1, wherein the vacuum is in a range from about 7 to about 250 mbar.
13. The method of claim 1, wherein the vacuum is preferably in a range from about 15 to 50 about mbar.
14. The method of claim 1, wherein the solid neutral catalysts are selected from the group consisting of aluminium, antimony, barium, lead, cadmium, iron, copper, manganese, titanium, tin, zinc, and their oxides, salts, alloys, and combinations thereof.
15. The method of claim 1, wherein the reactor is a tower shaped reactor with at least two packing beds being arranged within.
16. The method of claim 1, wherein the solid neutral catalyst exists in a form of spirals.
17. The method of claim 1, wherein the mixture containing alcohol and water is a fractionated condensation, wherein condensed alcohol re-enters the reactor.

18. The method of claim 1, wherein the esterification process further comprises letting out neutralized fat produced by the reactor and removing possible catalyst remnants and other contaminants by washing with an aqueous organic acid in an amount ranging from about 0.05 to about 0.5 percent aqueous citric acid solution.
19. The method of claim 1, wherein the vegetable and/or animal fats or oils are transformed into a pumpable state and inserted into the reactor.
20. The method of claim 19, wherein the pumpable vegetable and/or animal fat comprises running the fat through a coarse filter before entering the reactor where the removal of suspended particles or grains of sand and other granular contamination occurs.
21. The method of claim 1, wherein neutralized vegetable and/or animal fat is directed into a power plant selected from the group consisting of a combined heat and power unit and a large diesel engine.
22. The method according to claim 21, wherein heat produced by operating the power plant is used for heating the reactor and pre-heating the vegetable or animal fat.
23. An apparatus for implementation of the method of claim 1 comprising a tower apparatus (2) with at least one packing bed (3) of solid neutral catalyst, an inlet (4) in the upper part of the tower apparatus to insert the fat, an outlet (5) in the lower part of the tower apparatus for removal of the neutralized fat, an inlet (6) in the lower part of the tower apparatus to insert alcohol, so that it runs counter current through the packing bed to the fat which is to be treated, an outlet (7) in the upper part of the tower apparatus from which a mixture containing water and alcohol is drained by means of a vacuum pump (8).
24. The apparatus of claim 23, wherein at least two packing beds are arranged within.

25. The apparatus of claim 23 further comprising a device (8/9) for condensation of the alcohol-water mixture intended for separate condensation of alcohol and water, thereby directing the initially condensed alcohol back into the tower apparatus through a conduit (10).

26. The apparatus of claim 23, further comprising a spiral shaped neutral solid catalyst arranged in a packing bed.